

REMARKS

In response to the Final Office Action dated December 12, 2006, Applicants respectfully request reconsideration based on the following remarks. Applicants respectfully submit that the claims as they currently stand are in condition for allowance.

Claims 1-6 are pending in the present application. Claims 1-6 have been rejected. Claims 1-6 remain for further consideration upon the entry of the present Response. No new matter has been added.

Claim Rejections Under 35 U.S.C. § 103

Claims 1-6 stand rejected under 35 U.S.C. § 103(a) as being allegedly unpatentable over Paranjpe et al. (U.S. Patent Publication No. 2003/0003635, hereinafter “Paranjpe”) in view of Lim et al. (U.S. Patent No. 6,723,598, hereinafter “Lim”). The Examiner states that Paranjpe discloses all of the elements of Claims 1-6 except: (1) *spraying an ozone gas through first spray holes, at the same time, spraying an inert gas through second spray holes, and spraying a TMA gas through the second spray holes, at the same time, spraying the inert gas through the first spray holes*, and (2) *values for the flow rates or duration of exposure of the ozone, carrier, purge, and TMA gases, and the concentration of the ozone gas*, which the Examiner alleges would have been obvious to one of ordinary skill in the art.

The Examiner states that Paranjpe discloses that the values of the flow rates and duration for each step of the ALD process depend upon the apparatus and conditions employed in the invention and their importance is only to achieve a desired aluminum oxide film quality, therefore are result effective, and thus not inventive. In addition, the Examiner states that Paranjpe does not disclose *vacuum purging between depositions*, which the Examiner alleges is disclosed in Lim primarily at Col. 2, lines 21-35. The Examiner further states that it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Paranjpe to include vacuum purging between pulses of gases in the ALD process as taught by Lim in order to remove unreacted precursors. Applicants respectfully traverse for at least the reasons presented hereinbelow.

Claim 1 includes the ozone feeding step (S2-1) for supplying ozone gas on a substrate, the ozone purging step (S2-2) for removing unreacted gas with inert gas, the TMA feeding step (S2-3) for supplying TMA gas on a substrate, and the TMA purging step (S2-4) for removing

unreacted gas with inert gas. Furthermore, Claim 1 as previously amended features a vacuum purging step which is selectively performed between any two steps of the ALD cycle of steps (S2-1), (S2-2), (S2-3), and (S2-4).

In the prior art including Lim et al., it is disclosed that unreacted gas or by-product is discharged by flowing an inert gas or vacuum purging between the one reactive gas supplying step and the other reactive gas supplying step. Namely, as a purging method, inert gas purging or vacuum purging can be selected. Therefore, the vacuum purging in addition to the inert gas purging of present Claim 1 is not disclosed in the prior art including Lim et al.

For example, the process recited in present Claim 1 includes, *inter alia*: feeding a first gas (S2-1) -> purging the first gas with inert gas (S2-2) -> vacuum purging -> feeding a second gas (S2-3) -> purging the second gas with inert gas (S2-4) -> vacuum purging. Meanwhile, the process of Lim merely includes: supplying (feeding) a first gas -> purging the first gas with inert gas or vacuum purging -> supplying (feeding) a second gas -> purging the second gas with inert gas or vacuum purging.

The main purpose of the inert gas purging is to remove the unreacted gas stuck physically to a substrate or a by-product, but the main purpose of the vacuum purging is to remove the previously supplied gas in trenches (holes) formed in the substrate.

Because the aspect ratio of the trench in the substrate is 1:30 ~ 1:60, the purging method using only inert gas as in the prior art can remove the unreacted gas on the top surface of a substrate or a by-product remaining in the chamber easily, but it cannot effectively remove the previously supplied gas remaining in trenches. Therefore, the newly supplied gas cannot penetrate in the trenches and the step-coverage ability is reduced. The invention of present Claim 1 can remove the residual gas in the trenches easily and improve the step-coverage ability by making the penetration of the next gas into the trenches effective because it progresses the manufacturing process using vacuum purging in addition to inert gas purging.

Also, if vacuum purging is appropriately used, the efficiency of purging can be increased compared to the case where only the inert gas is used. The vacuum purging in addition to the inert gas purging can exhaust the remaining reactive gas on the substrate and in the reaction chamber through the exhaust line more effectively and more clearly before the next reactive gas is supplied to the reaction chamber.

In particular, neither Paranjpe et al. nor Lim et al., either alone or in combination, teach or suggest vacuum purging, which is selectively performed between any two steps of the ALD cycle of steps (S2-1), (S2-2), (S2-3), and (S2-4), wherein the vacuum purging is performed while preventing all the gases from inflowing into the reaction chamber, as in Claim 1. Therefore, Claim 1, including claims depending therefrom, i.e., claims 2-6, define over Lim et al.

Accordingly, it is respectfully requested that the rejection to claims 1-6 under § 103(a) be withdrawn and allow the same to issue.

Conclusion

In view of the foregoing remarks distinguishing the prior art of record, Applicants submit that this application is in condition for allowance. Early notification to this effect is requested.

The Examiner is invited to contact Applicants' Attorneys at the below-listed telephone number regarding this Amendment or otherwise regarding the present application in order to address any questions or remaining issues concerning the same.

If there are any charges due in connection with this response, please charge them to Deposit Account 06-1130.

Respectfully submitted,

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Date: March 12, 2007